Assessment the engineering department's of Indian institute of technology, kanpur by statistical method

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ABSTRACT

The study has been done on the basis of survey questionnaire in the Engineering departments (under graduate) of Indian Institute of Technology, Kanpur to measure the current or baseline departmental performance level. The feedback for this survey questionnaire has been considered independently for service providers such as administrators, faculties, other supporting staff as well as students who receive these services and are direct customers. A total of 116 persons have been surveyed from the 6 randomly selected departments out of 10 departments. The baseline or current performance level of the departments has been assessed based on the coefficient of variation (CV%) level through quantification of the survey questionnaire consisting of eight enablers. Each enabler contains several questions or drivers. A total of 75 drivers have been arrived for 8 enablers. A seven-point scale has been designed for each driver ranging from "Unsatisfactory" to "Outstanding". To identify the weak areas for a department, the vital few drivers that correspond to "Unsatisfactory" performance have been found to take necessary remedial measures for attaining the new benchmark Coefficient of Variation level (CV%) under the present techno-economic set up.

Introduction

The India Indian Institute of Technology, Kanpur has come up in India the topmost engineering institution. Earlier, the State Government alone patronized Engineering Colleges. However, to meet the growing demand for engineering education, it was a policy decision of the education planners to increase the 'supply' by augmenting, in turn, the capacity through increasing the number of engineering colleges manifold sponsoring by Indian Government. To bridge this gap between demand and supply, one option was to open more Government engineering colleges. But partially due to lack of fund (Chaudhuri, D et al., 2009) of State Government constraint and partially due to a tilt toward privatization including, but not restricting to education, Indian Institute of Technology have come up along with a few more Indian Institute of Technology sponsoring by Indian Government.

The aim of the Institute is to provide meaningful education, to conduct original research of the highest standard and to provide leadership in technological innovation for the industrial growth of the country. The Institute began functioning in 1959 with 100 students and a small faculty. The Institute now has its own sprawling residential campus, about 2255 undergraduate and 1476 postgraduate students, 309 faculties and more than 900 supporting staff. The combined record of its past and present faculty and students along with the alumni spread across the world is awe-inspiring. With the path-breaking innovations in both its curriculum and research, the Institute is rapidly gaining alegendaryreputation(http://www.iitk.ac.in/infocell/iitk/newhtml/history.htm)In this circumstance, it has been decided to undertake this study to assess the 'as is' situation of the departments in Indian Institute of Technology, Kanpur measured through baseline coefficient variaton level (CV%) obtained from survey questionnaire.

Side by side, identification of vital few weak areas has been made through application of Pareto Analysis of defects per million opportunities (DPMO) and benchmark or target Coefficient of Variation level (CV%) have been evaluated. It goes without saying that it is possible to achieve the target coefficient variaton level (CV%) once appropriate remedial measures are taken corresponding to the identified weak areas even under the existing set up. The bottom most coefficient of variation level (CV%) is the benchmark level. Certainly, breakthrough kind of improvement is possible to achieve provided much better resources and infrastructure are brought in.

Objective

Unlike other industries, for a given system like a University, themselves may deny students as customers the role of specifying their needs (Chaudhuri, D et al., 2010). However, the students have expectations about benefits to be derived from University education (Mukherjee, S.P., 1996). Keeping this in mind this study has been undertaken with the following objectives.

To design a questionnaire for surveying among faculties, students, administrators and other supporting staff of Indian Institute of Technology, Kanpur. Accordingly, the enablers and the corresponding drivers are decided based on literature survey and interaction with a few key men organizing the Joint Entrance Examination, the selection test, for screening the candidates.

1. To draw samples (departments) in a random manner from all the departments.

2. To categorize the sampled departments in four categories – say 'excellent', 'very good', 'good', and 'so so' – based on the above interaction.

3. To quantify the 'as is' or 'baseline' Coefficient of Variation level (CV%) of the samples based on the survey questionnaire.

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4. To quantify the 'benchmark Coefficient of Variation level (CV%) for the above samples.

5. To identify the weak areas (the enabler driver combination) for the samples, overcoming which the 'benchmark' can be achieved.

6. To categorize the sample departments and arrive at department-wise rating based on present Coefficient of Variation level (CV%).

Survey method

A questionnaire has been designed to survey the perceptions of different stakeholders (faculties, students, administrators and other supporting staff) taking cue from the paper (Parasuraman, A., 1988) that discussed five dimensions for assessing service quality [SERVQUAL] consisting of tangibles, reliability, responsiveness, assurance, and empathy. The enabler-result model that influences the key performance results of a department for different indirect customers like guardians, employers and the society at large is depicted in Figure 1

Figure 1:Enabler-result model
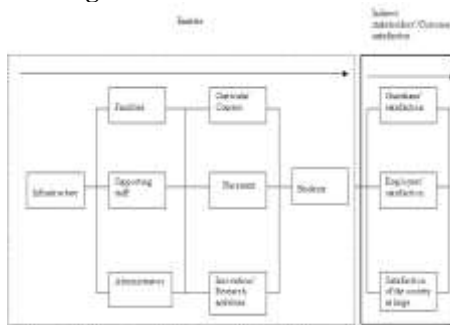
It can be seen in Annexure 1 that appropriate drivers or questions drive the enablers. For each driver, driving an enabler, a seven-point scale has been developed ranging from 'outstanding' to 'unsatisfactory' in line with the Likert Scale (Helman, M., 2006;Wilson, J.R et al., 2002).

For the sake of convenience in conducting the survey, a scoring scheme has been evolved for mapping the corresponding level of the responses ranging from 'outstanding' to 'unsatisfactory'. The scoring scheme is given in Table 1.

The names of departments, out of 10, falling in different categories –'excellent',' very good', 'good', and 'so so'- are given in Table 5.

The different departments that have been covered for the sample along with the number of persons surveyed are given in Table 2. It can be seen that a total of 116 persons have been surveyed for the 6 randomly selected departments out of a total of 10 engineering departments and administration of Indian Institute of Technology, Kanpur. Table 3 demonstrates that out of these 116 persons surveyed, 53 represent students, 37 represent faculties, 24 represent other supporting staff and 2 represent administrators.

Operational definition

Enablers: - These are the entities that determine how the things are done in a department to have direct bearing on the key performance results.

Drivers: - These are the specific questions framed in a questionnaire corresponding to different 'enablers'. The replies for these drivers are taken in a 7-point scale ranging from 'outstanding' (AA) to 'unsatisfactory' (D).

Defects: - It is the number of 'D's ('unsatisfactory' tick mark) for an enabler that is responded by different people – faculties, administrator, other supporting staff and students.

Unit: - It is the number of respondents who have responded in this study for any enabler through survey questionnaires. It can

also correspond to the number of filled in questionnaires.

Opportunity: - It is the product of number of respondents and number of drivers for an enabler.

Measuring coefficient of variation

The Coefficient of Variation (CV %), a lower the better measure, is defined as $CV\% = \left(\dfrac{\sigma}{\mu}\right) \times 100$ where, σ is the population standard deviation and μ is the population mean of the distribution. When the standard deviation (s) and the average ($\overline{X}$) are estimated from the sample observations, the coefficient of variation is estimated as,

$$CV\% = \left(\frac{s}{\overline{X}}\right) \times 100$$

Analysis and result

It has been found that the Coefficient of Variation level (CV%) of different departments ranges between 9.05 to 19.55. Accordingly, The categories in which the deepartments are grouped are given in Table 4.

Based on the baseline coefficient variaton (CV%) levels attained by different departments, a ranking of the departments has been made and is furnished in Table 5.Table 5 provides the department-wise ranking, also.

In order to identify the root causes for the weak areas or enablers irrespective of any department, Pareto analysis (Juran et al., 1988) has been carried out for the corresponding drivers. For the sake of convenience, the drivers have been given a serial number irrespective of enablers (see Annexure 1).

Based on the Pareto analysis, the "vital few" drivers, which are common for all the departments of Indian Institute of Technology, Kanpur have been found and the corresponding enablers are noted down (see Table 6).

Conclusion

The overall ratings (Coefficient of Variation level (CV%) of the departments in Indian Institute of Technology, Kanpur range from 9.05 to 19.55.

It is possible for a department to attain at least the benchmark Coefficient of Variation level (CV%) mentioned in Table 5 by adopting appropriate remedial measures with respect to the identified weak areas in Table 6. The possible remedial measures are given in Table 7.

Recommendations

Instead of going by the popular perception of the Indian Institute of Technology, Kanpur, it is much better to categorize the departments based on the class intervals of baseline coefficient variation level (CV%) as demonstrated in Table 4.

It is always preferable to evaluate and categorize the departments based on objective criteria like computation of baseline Coefficient of Variation level (CV%) that has been demonstrated in this article.

It is also recommended that the 'excellent' departments, as per present Coefficient of Variation level (CV%), should enhance their intake to give more chance the students for admission in such the departments.

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Table 1: Scoring scheme for the responses for drivers

Serial Number	Level of response	Scoring scheme
1.	Outstanding/Most difficult/Most uncompromising/Heaviest penalty/ Very heavy teaching load	AA
2.	Excellent/Very difficult/Quite uncompromising/Quite heavy penalty/ Heavy teaching load	A+
3.	Very Good/Reasonably difficult/Reasonably uncompromising/Reasonable penalty/ Reasonably high teaching load	A
4.	Good/Difficult/Uncompromising/Penalty/ Moderate teaching load	B+
5.	Satisfactory/Not so difficult/Not so uncompromising/Marginal penalty/ Marginal teaching load	B
6.	Marginal/Easy/Compromising/Insignificant penalty/ Very insignificant teaching load	C
7.	Unsatisfactory/Very easy/Very much compromising/No penalty/ No worth-mentionable teaching load	D

Table 2: Departments and number of persons surveyed.

Dept. / Institution	Administration	Aerospace Engineering	Biological science &Bioengineering	Chemical Engineering	Civil Engineering	Computer science & engineering	Electrical engineering	Industrial & Management engineering	Material & Metallurgical engineering	Mechanical Engineering
Indian Institute of Technology, Kanpur	*(2)			*(28)	*(22)	*(22)	*(20)		▢	▢*(22) ▢

Total number of person surveyed   116

* Indicates the surveyed department.

** Figures within parentheses represent number of people surveyed.

Table 3: Break-up of various persons surveyed

Name of the Institution	Administration	Students	Faculties	Other supporting staff	Total Number of persons surveyed in a department
Indian Institute of Technology, Kanpur	2	53	37	24	116

Table 4: Categories of the departments based on the study

Category	Class interval for present Coefficient of Variation level (CV%)	Number of departments based on the study
So So	19.70-17.08	1
Good	17.08-14.40	3
Very Good	14.40-11.76	1
Excellent	11.76-9.11	1

Table 5: Present Coefficient of Variation level (CV%) and Benchmark Coefficient of Variation level (CV%) of engineering departments.

Department	Present Sigma	Ranking of the surveyed departments	Present category
Chemical Engineering	9.05	1	Excellent
Electrical Engineering	14.09	2	Very Good
Mechanical Engineering	15.23	3	Very Good
Computer Science & Engineering	15.95	4	Very Good
Civil Engineering	16.05	5	Good
Administration	19.55	6	So So

Table 6: Weak areas or vital few drivers of the engineering departments.

Revised Rank	Department	Weak areas/drivers common for all the departments	Corresponding Enablers
1	Chemical Engineering	12,38,40	Students, Curricula/Courses
2	Electrical Engineering	12,38,40	Students, Curricula/Courses
3	Mechanical Engineering	12,38,40	Students, Curricula/Courses
4	Computer Science & Engineering	12,38,40	Students, Curricula/Courses
5	Civil Engineering	12,38,40	Students, Curricula/Courses
6	Administration	12,38,40	Students, Curricula/Courses

Table 7: The possible remedial measures for identified weak areas

Enabler	Driver	Remedy
Students	12	Admission should be done only by merit basis as per the IIT Joint Entrance all India basis examination.
Curricula/Courses	38	Scope has to be explored to earn substantially through self-financing course
	40	At least a reasonably high teaching load has to be borne by faculties.